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CLAIMS

1. A method of producing a digital beamformer signal using output signals generated by an array of antenna elements in response to the reception of electromagnetic waves, where each antenna element is directly associated with an antenna module, each of which processes an output signal generated by a corresponding antenna element **characterized in that** the method comprises the steps of:

- each antenna module providing a working frequency signal from the output signal generated by the corresponding associated antenna element;
- each antenna module converting the working frequency signal to a complex digital antenna signal at a first data rate;
- each antenna module multiplying the complex digital antenna signal with a complex beam coefficient generating a complex beam element signal at a second data rate;
- asynchronously adding the generated complex beam element signals in groups comprising at least two antenna modules forming a complex beam signal by means of complex adders on the respective antenna modules being intercoupled to form respective serial asynchronous complex adding chains;
- providing the digital beamformer signal from the complex beam signal.

2. The method according to claim 1, **characterized in that** the first data rate and the second data rate are the same.

3. The method according to claim 1, **characterized in that** the second data rate is a multiple of the first data rate, and in that the method further comprises the step of:

- in each antenna module changing the complex beam coefficient in pace with the second data rate to thereby at the first data rate generate a multiple of complex beam signals, each of which represents a predetermined beam.

4. The method according to claim 3, **characterized in that** the multiple of complex beam signals are time multiplexed on the serial asynchronous complex adding chains.

5. The method according to claim 3, **characterized in that** each antenna module comprises further complex adders forming multiple serial asynchronous complex adding chains associated with each antenna module, the multiple of complex beam signals being spatially multiplexed on the multiple of serial asynchronous complex adding chains.

6. The method according to claim 3, **characterized in that** each antenna module comprises further adders forming multiple serial asynchronous complex adding chains associated with each antenna module, the multiple of complex beam signals being both spatially and time multiplexed on the multiple of serial asynchronous complex adding chains.

7. The method according to any one of claims 1 to 6, **characterized in that** in the step of asynchronously adding the generated complex beam element signals, adding is performed on a group comprising all antenna modules.

8. The method according to any one of claims 1 to 6, **characterized in that** in the step of asynchronously adding the generated complex beam element signals in groups, the antenna modules are divided into at least two groups, and in that the step of providing the digital beamformer signal from the complex beam signal, additionally determines the complex beam signal from

the digital beamformer signal of each group serial asynchronous complex adding chain.

9. An array antenna comprising at least two antenna elements arranged for reception of electromagnetic waves, and comprising a beamformer arranged to form at least one reception beam **characterized in that** at least a part of the beamformer is directly associated with a respective antenna element, each part of the beamformer being directly associated with an antenna element forms an antenna element module of that antenna element, where an antenna element module comprises:

- a receiver arranged to provide a working frequency signal;
- an analog to digital converter and I/Q splitter arranged to transform the working frequency signal from the receiver into I and Q digital complex signals at a first data rate;
- a multiplier arranged to multiply the complex digital I and Q signals with a complex beam coefficient forming a complex beam element signal at a second data rate;
- an element latch arranged to freeze the complex beam element signal by a clock signal to form a latched complex beam element signal;
- an asynchronous complex adder arranged to add the latched complex beam element signal with an input complex part beam signal, forming an output complex part beam signal;

and in that the output part beam signals of one antenna element module is coupled to the input complex part beam signal of a further antenna element module thus forming a serial asynchronous summing path of the latched complex beam element signals of the antenna element modules generating a complex beam signal.

10. The array antenna according to claim 9, **characterized in that** the antenna further comprises a beam latch arranged to store the complex beam signal by the clock signal, the element latch and the beam latch are both clocked at the same time.

11. The array antenna according to claim 10, **characterized in that** the element latch and the beam latch are clocked at the first data rate.

12. The array antenna according to claim 10, **characterized in that** the element latch and the beam latch are clocked at the second data rate, the second data rate being a multiple of the first data rate, and in that the complex beam coefficient is changed in pace with the second data rate to thereby at the first data rate generate a multiple of complex beam signals, each of which represents a predetermined beam.

13. The array antenna according to claim 12, **characterized in that** the multiple of complex beam signals are time multiplexed on the serial asynchronous summing path.

14. The array antenna according to claim 10, **characterized in that** the second data rate is a multiple of the first data rate, and in that the complex beam coefficient is changed in pace with the second data rate to thereby at the first data rate generate a multiple of complex beam element signals, each of which represents a predetermined beam, and in that each of the antenna element modules further comprises:

- one or more additional element latches arranged to freeze a complex beam element signal by a clock signal to form one or more additional latched complex beam element signals at a third data rate;
- one or more additional asynchronous complex adders each arranged to add one of the one or more additional latched complex beam element signal with an input complex part beam signal, each forming an additional output complex part beam signal;

and in that each additional output part beam signal of one antenna element module is coupled to a corresponding additional input complex part beam signal of a further antenna element module thus forming one or more additional serial asynchronous summing paths of the one or more additional latched

complex beam element signals of the antenna element modules generating one or more additional complex beam signals, and in that the antenna further comprises one additional beam latch for each additional serial asynchronous summing path, each additional beam latch being arranged to store the additional complex beam signal by the clock signal, the one or more additional element latches and the one or more beam latches are clocked at the same time.

15. The array antenna according to claim 14, **characterized in that** the third data rate is the same as the first data rate, thus each corresponding element latch and beam latch are clocked at the first data rate and all the complex beam signals are spatially multiplexed on the serial asynchronous summing path and on the one or more additional serial asynchronous summing paths.

16. The array antenna according to claim 14, **characterized in that** the third data rate is a multiple of the second data rate and in that the element latch and the beam latch are clocked at the third data rate, all the multiple of complex beam signals thus being both spatially and time multiplexed on all the serial asynchronous summing paths.

17. The array antenna according to any one of claims 9 to 16, **characterized in that** all of the antenna element modules of the array antenna are comprised in all of the serial asynchronous summing paths.

18. The array antenna according to any one of claims 9 to 16, **characterized in that** the antenna element modules of the array antenna are divided into at least two groups, each group having separate serial asynchronous summing paths, the complex beam signals being fed into a central beamformer part for final computation of the corresponding beams.